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March 24*th*.

Vice President **Bridges** in the Chair.

The following communications were presented for publication in the Proceedings.

1. Synopsis of the species of Clivina and allied genera inhabiting the United States, by John L. LeConte, M. D.
2. Investigation of the Rock Guano of the Islands of the Caribbean Sea, by W. J. Taylor.
3. Description of six new species of Unio from Alabama, by Isaac Lea.
4. Description of eight new species of Naïades, from various parts of the United States, by Isaac Lea.
5. Description of three new exotic species of Naïades, by Isaac Lea.
6. List of Extinct Vertebrata, the remains of which have been discovered in the region of the Missouri, with remarks upon their geological age, by Joseph Leidy, M. D.

And were respectively referred to Committees.

Mr. Cassin announced the death of Mr. John A. Guex, late a member of the Academy, and alluded to the enthusiasm of Mr. Guex as an entomologist, and to his distinguished liberality in adding to the museum of the Academy his magnificent collection of Coleoptera.

March 31*st*.

Vice President **Bridges** in the Chair.

The following papers on report of the Committees to which they were referred, were ordered for publication in the Journal.

On the Caducibranchiate Urodele Batrachians, by Edward Hallowell, M. D.

On Trignophrys rugiceps, by Edward Hallowell, M. D.

And the following for publication in the Proceedings.

Synopsis of the species CLIVINA and allied genera inhabiting the United States.

BY JOHN L. LECONTE, M. D.[*]

DYSCHIRIUS Bon.

A. Elytra stria vel interstitio 3io tripunctato.	
A. Epistoma bisinuatum; elytra stria basali integra.	
a. clypeo tridentato;	
·18, Antennis nigris, thorace globoso, elytrorum striis integris	1. tridentatus *Lec.*
b. clypeo dente intermedio obsoleto, lateralibus acutis;	
·14, Antennis pedibusque nigerrimis	2. patruelis *Lec.*
·13, Antennis basi, pedibusque posterioribus rufis	3. basalis *Lec.*
(·13, Pedibus antennisque brunneis, his basi testaceis, thorace antice angustato,	4. Dejeanii *Putz.*

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[*] The species which I have not seen are enclosed in a bracket; in some instances I have not been able to discover their characters from the description.

B. Epistoma late emarginatum, bidentatum ; elytra stria basali nulla.

c. Frons transversim leviter vel vix impressa ;

(elytra striis postice exaratis ;)

·12, Thorace subtransverso ; pedibus subnigris 5. integer *Lec.*
·12, Thorace minore globoso ; pedibus nigris 6. nigripes *Lec.*
·13, Thorace minore globoso ; elytris striis profundis fortiter punctatis : pedibus nigris 7. consobrinus *Lec.*
·15, Thorace globoso ; elytris striis tenuibus parcius punctatis, pone basin impressis 8. gibbipennis *Lec.*

d. Frons transversim sulco impressa ;

§. striis elytrorum ad basin extensis, postice obliteratis ;

·15, Thorace globoso ; elytris striis tenuibus, antennis pedibusque nigris 9. æneolus *Lec.*
·11, Thorace globoso ; elytris striis fortioribus, antennarum basi pedibusque rufis 10. longulus *Lec.*
·09—·12, Thorace tranverso, ovato ; antennis pedibusque rufis 11. globulosus *Putz.*

§§. striis elytrorum antice abbreviatis ; antennis pedibus elytrorumque apice rufis.

α. striis postice obliteratis ;

·13, Thorace transverso ovato ; elytris striis fortiter punctatis 12. hæmorrhoidalis *Putz.*
·13, Thorace quadrato-globoso ; elytris striis leviter punctatis 13. terminatus *Lec.*

β. striis integris ;

·12, Thorace quadrato-globoso ; elytris striis fortiter punctatis 14. analis *Lec.*

B. Elytra interstitio 3io bipunctato, vel impunctato, ad basin haud marginato.

A. Tibiis anticis extrorsum haud vel vix dentatis ;

a. Ænei, capite lævi, nitido ; pedibus rufis.

§ Striis elytrorum integris profundis.

·22, Clypeo bisinuato tridentato 15. sphæricollis *Putz.*
(·28, Clypeo emarginato, bidentato, thorace elongato, antice valde angustato 16. edentulus *Putz.*

§§ Striis elytrorum nonullis antice abbreviatis.

·22, Clypeo truncato ; thorace ovato, transverso 17. truncatus *Lec.*
·20, Clypeo truncato ; thorace ovali, haud transverso 18. erythrocerus *Lec.*

b. Testacei vel rufi, capite rugoso, opaco, elytris pallidis macula communi obscura.

·18, Clypeo bidentato ; thorace rotundato, subtransverso 19. sellatus *Lec.*
·14, Clypeo vix bidentato ; thorace trapezoideo, oblongo 20. pallipennis *Putz.*

B. Tibiis anticis extrorsum dentatis ; stria 8va postice exarata.

§ Striis elytrorum profundis integris.

(·12, Ferrugineus ; tibiis anticis calcari terminali valde curvata 21. curvispinus *Putz.*

§§ Striis elytrorum antice abbreviatis ; (nigro-ænei, pedibus rufis.)

·14, Valde elongatus ; elytrorum striis postice haud obliteratis ; clypeo acute bidentato 22. filiformis *Lec.*

(·12, Thorace oblongo, elytrorum striis postice subobliteratis 23. sublævis *Putz.*
·14, Thorace ovato, elytrorum striis postice subobliteratis; clypeo parum dentato 24. dentiger *Lec.*
·12, Thorace ovato, elytrorum striis postice obliteratis; clypeo acute bidentato 25. aratus *Lec.*
·11, Thorace ovali, elytrorum striis postice obliteratis; clypeo truncato 26. rufiventris *Lec.*

C. Elytra interstitiis 3io, 5to, et 7mo punctis setiferis uniseriatis.

·12, Thorace breviter ovato, elytris striis vix impressis postice obliteratis 27. setosus *Lec.*
·14, Thorace globoso, elytris striis impressis, internis subintegris 28. pilosus *Lec.*

Two species from Russian America, D. transmarinus *Mann.* and D. frigidus Mann. Bull. Mosc. 1853, Nos. 11 and 12, appear quite distinct from any above described, but the characters given are not such as enable me to place them in the table.

1. *D. convexus* Lec. Ann. Lyc. 5, 195, is a variety of D. tridentatus with more flattened elytral intervals.

6. *D. apicalis* ||Lec. Agass. Lake Sup. 204, is changed to D. nigripes *Lec.* Trans. Am. Phil. Soc. 10, 396.

10. D. pumilus Putz. is perhaps D. longulus Lec., but the description is hardly sufficient.

11. *D. parvus* Lec. Agass. Lac. Sup. 204, is merely a small variety of D. globulosus.

3. D. basalis, nigro-æneus, nitidus, clypeo trilobato, lobo medio breviore obtuso, vertice subtilissime cristato, thorace globoso, elytris thorace sublatioribus, striis antice punctatis, postice integris, ad apicem exaratis, marginali per basin continuata, interstitio 3io tripunctato, antennis fuscis, basi pedibusque rufis, tibiis anticis dente inferiore acuto, superiore minuto. Long. ·13.

Fort Yuma, Colorado River, California. This species has the form, size and sculpture of D. integer *Lec.*, from the same locality, but differs by the more globose thorax, and trilobed clypeus; the anterior thighs of D. integer are also nearly black, while in the present they are dark red. The marginal stria in D. integer ceases at the humerus: in the present it is distinctly continued along the base: the dorsal striæ do not completely attain the anterior declivity, they are punctured behind the middle, then smooth to the tip; although not deep they are entire, and the first, second, seventh and eighth, are deeper at the apex: the eighth is obliterated for the rest of its course as usual. The upper tooth of the anterior tibiæ is very small, the second one is prominent, the terminal is as long as the terminal spur, and both are slightly curved.

8. D. gibbipennis, elongatus nigro-æneus pernitidus, clypeo late emarginato, angulis prominulis, fronte transversim paulo impressa, et dein plica parva brevissima notata, thorace latitudine haud breviore, globoso, elytris tripunctatis, pone basin impressis, striis punctatis haud impressis, externis postice exaratis, antennarum basi pedibusque obscure rufis, tibiis anticis bidenticulatis. Long ·15.

One specimen found at San Diego, California. More robust than D. terminatus, but more slender than D. globulosus, having about the proportions of D. nigripes *Lec.* Black, more bronzed than usual, and very shining; head with deep frontal impressions, and a slight transverse line in front of the eyes, which connects with an almost imperceptible medial fold: clypeus broadly emarginate, truncate at the middle, with the angles distinct, not very acute: lateral margin lobed, as usual. Palpi and antennæ piceous, the latter obscure rufous at the base. Thorax almost exactly globose, slightly truncate in front, anterior transverse impression deep, dorsal line very fine. Elytra slightly wider than the thorax, not quite twice as long as their width, convex; near the suture, toward the base, the surface is more convex, and this convexity is followed by a deep impression near the suture, about the anterior fourth: the striæ are punctured but not impressed, they become obsolete at the latter fourth, and impressed at their terminations, but the seventh and eighth are sinuate and impressed behind to the very apex; the tip of the third is not impressed: the marginal ceases at the humerus: the first, fourth and fifth commence at the declivity of the base, the others are a little shorter; the intervals are entirely flat and the third is tripunctate. The legs are very dark rufous; the anterior tibiæ are armed externally with a small denticle, and an acute tooth; the apical tooth is long and curved, the inferior spur is one-third shorter, and slightly curved.

17. D. truncatus, nigro-æneus, nitidus, clypeo truncato, vix emarginato, fronte transversim haud profunde impressa, thorace latitudine subbreviore, ovato antrorsum angustato, elytris striis impressis antice punctatis, 3ia haud distincte bipunctata, 8va obsoleta, ad apicem exarata, interstitiis planis, palpis pedibusque ferrugineis, antennis piceis ad basin ferrugineis, tibiis anticis vix denticulatis. Long. ·22.

One specimen, Illinois, Mr. Wilcox. Of the same size as D. sphæricollis, but more robust, and known at once by the ovate thorax and almost squarely truncate clypeus. Blackish bronzed, shining: head with deep frontal impressions, transverse line not profound: clypeus almost truncate with the angles rounded not prominent; sides lobed as usual: antennæ rufo-piceous, with the base red. Palpi and mouth reddish. Thorax a little broader than long, ovate, narrowed in front; dorsal line and transverse anterior impression deep. Elytra not wider than the thorax, less than twice as long as their width, convex: striæ impressed and entire, the first, fourth and fifth commence on the declivity of the base, the others are a little shorter, the eighth is obsolete and represented by only a few punctures, but is deep at the tip: the punctures are moderately large and extend a little beyond the middle; the marginal stria ends at the humerus: the interstices are flat, and in contact with the third stria may be seen two hardly distinct dorsal punctures. The body beneath is black; the legs are dark red; the anterior tibiæ have hardly a trace of external denticles, the terminal tooth is long and gradually curved, the terminal spur is shorter and slightly curved.

18. D. erythrocerus, elongatus, æneo-niger, nitidus, clypeo fere truncato, vix emarginato, angulis parum prominulis, fronte transversim impressa, thorace latitudine longiore, subovato, elytris striis impressis, ad basin abbreviatis antice fortiter punctatis, 8va obsoleta ad apicem exarata, interstitiis fere planis, antennis palpis pedibusque rufis, tibiis anticis vix denticulatis. Long. ·20.

Ohio. Dr. Schaum: Pennsylvania, Haldeman. Differs from the preceding by the more slender form, deeper transverse frontal impression, and pale antennæ.

19. D. sellatus, piceo-rufus, nitidus, clypeo late emarginato, acute bidendato, fronte transversim impresso, capite granulato rugoso, thorace convexo, latitudine paulo breviore, ovato, elytris cylindricis convexis, pallidis, umbra scutellari alteraque communi pone medium obscuratis, antennis pedibusque testaceis. Long. ·18.

Found at Atlantic City, on the coast of New Jersey; allied to D. pallipennis *Putz.* (*Clivina pallipennis* Say) but is much larger, and more robust, with a more globose and slightly transverse thorax, and more strongly bidentate clypeus.

22. D. filiformis, æneo-niger, nitidus valde elongatus, clypeo late emarginato bidentato, fronte transversim impressa, thorace latitudine haud breviore, quadratim ovato, convexo, antrorsum subangustato, elytris cylindricis, striis antice fortiter punctatis, postice fere integris, ad apicem breviter exaratis, abdomine postice, antennis pedibusque testaceis, tibiis anticis dente inferiore elongato, superiore minuto. Long. ·14.

Coney Island, near New York, in salt marsh. Quite as slender as D. terminatus *Lec.* shining brassy black. Head with clypeus broadly emarginate, and acutely bidentate, front with a deep transverse line : antennæ testaceous, mouth reddish. Thorax not wider than long, subquadrate ovate, sides not converging much in front, convex, anterior transverse impression feeble, dorsal line entire, fine. Elytra not wider than the thorax, twice as long as their width, cylindrical: striæ commencing behind the anterior declivity of the base, strongly but distantly punctured nearly to the middle, the inner ones are then deep and impunctured nearly to the tip, where they are less deep, but at the extreme tip are again deeply impressed as in many other species: the interstices are convex, the third not punctured : the outer striæ are less deep, and the eighth is almost effaced: the marginal ceases at the humerus. The abdomen is rufo-testaceous, paler towards the tip: the legs are testaceous, the anterior tibiæ are armed externally with two teeth, the upper very small, the lower acute and prominent: the terminal tooth is long and slightly curved, the inferior spur is not longer than the tooth, but is more curved.

24. D. dentiger, elongatus, nigro-æneus nitidus, clypeo late emarginato angulis prominulis, fronte transversim paulo impresso, thorace latitudine vix breviore, antrorsum angustato, subgloboso, elytris striis punctatis, postice parum obliteratis, internis antice abbreviatis; stria basali transversa nulla, apicali unica brevi exarata; antennis pedibusque rufo-testaceis, tibiis anticis dente externo longo armatis. Long. ·14.

New York and Pennsylvania. More stout than D. terminatus and filiformis, but more elongate than usual. Blackish brassy, shining: head smooth with deep frontal impressions connected between the antennæ by a deep transverse line: clypeus broadly emarginate, with the angles prominent, but not very acute. Antennæ reddish testaceous. Thorax slightly broader than long, narrowed in front, subtrapezoidal, very much rounded behind, and convex, dorsal line and anterior transverse impression well marked. Elytra hardly wider than the thorax, about twice as long as the width, cylindrical, convex: striæ seven upon each, which are tolerably deep towards the base, but very fine and almost obliterated at the apex: the punctures are large and extend to about the middle : the marginal stria ceases at the shoulder, and the four interior striæ do not reach the declivity of the base. The under surface is black, and the legs are ferruginous: the anterior tibiæ are armed externally with a strong tooth near the apex, the upper denticle is obsolete, the apical tooth is long and curved: the interior apical spur is still longer and more curved.

26. D. rufiventris, nigro-æneus, nitidus, clypeo truncato, fronte transversim haud impressa, thorace latitudine haud breviore, ovali, antrorsum paulo angustato, elytris striis antice fortiter punctatis postice exaratis, ore abdomineque rufis antennis fuscis ad basin pedibusque testaceis, tibiis anticis dente inferiore acuto armatis. Long. ·11.

One specimen from Louisiana given me by Dr. Schaum. In the proportions of the body, and sculpture of the elytra this species resembles D. haemorrhoidalis, but the other characters are very different. The upper denticle of the anterior tibiæ is very small, the lower one is acute and prominent, the terminal tooth is long and curved, but the inferior spur is yet longer and more curved. The striæ of the elytra do not extend upon the anterior declivity ; they are very strongly punctured to the middle, and then become gradually obliterated to the tip, when the first, second and seventh are slightly impressed: the eighth stria is obliterated and the marginal ceases at the humerus : the interstices are convex, and the third are without punctures.

27. D. setosus, æneo-niger, nitidus, clypeo emarginato, bidentato, fronte transversim impressa, thorace latitudine breviore, ovato, trapezoideo, elytris convexis, grosse seriatim punctatis, postice lævigatis, interstitiis alternis punctis minutis setiferis uniseriatis notatis, antennis pedibusque testaceis, tibiis anticis dente inferiore acuto, superiore vix distincto. Long. ·12.

Massachusetts and New York, in salt marsh. A very curious species, more robust than usual and having nearly the proportions of D. globulosus.

The rows of large punctures on the elytra, which represent the striæ cease behind the middle, and at the tip only the extremity of the seventh stria is exarate: the rows of small interstitial punctures are four and extend nearly to the tip: each of them supports a long erect black hair, as in Bembidium laevigatum, and other long hairs are seen at the margin of the thorax. The anterior tibiæ have a scarcely distinct superior denticle, and an acute inferior tooth: the apical tooth is long and slightly curved, the spur is nearly as long and curved.

28. D. pilosus, æneo-niger, nitidus, clypeo emarginato, bidentato, fronte transversim impresso, thorace latitudine haud breviore, quadrato-globoso, elytris convexis, striis integris antice profundis et fortiter punctatis, interstitiis 1mo, 3io, 5to, 7moque parce uniseriatim punctatis et setosis, ano, ore, antennis pedibusque testaceis, tibiis anticis dente inferiore acuto, superiore vix distincto. Long. ·14.

New Orleans, Dr. Schaum. Allied to the preceding, but larger and less robust; the thorax is different in form and not at all transverse: the striæ of the elytra are impressed, and the inner ones may be traced to the very tip: the outer ones are obliterated, the eighth is entirely wanting: the marginal ceases at the humerus: the seventh is exarate at the tip as in the preceding. The anterior tibiæ are as in the preceding. A few long hairs are seen at the margin of the head and thorax, as in D. setosus.

ACEPHORUS Lec.

·25, Testaeeus, subnitidus, elytris subtiliter striatis, macula parva communa fusca notatis.	1. marinus *Lec.*

ARDISTOMIS Putz.

A. Elytra striata, glabra.	
·32, Nigra, antennis, pedibus, elytrorum macula utrinque postica rubris	1. obliquata *Putz.*
·22, Nigra, antennis pedibusque piceis, elytris interstitio 3io 5-punctato	2. Schaumii *Lec.*
B. Elytra seriatim punctata, punctis setiferis.	
·23, Nigro-viridis, antennis pedibusque rufis, thorace margine punctato	3. viridis *Lec.*
·23, Nigro-viridis, antennis pedibusque rufis, thorace disco parce punctato	4. puncticollis *Putz.*

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2. A. Schaumii, niger nitidus, capite angusto, thorace ovato, latitudine vix breviore, antrorsum valde angustato, elytris subvirescentibus, striatis, interstitiis parum convexis, 3io quinquepunctato, palpis testaceis, antennis pedibusque obscure rufo-piceis. Long. ·22.

Louisiana, very rare: given me by my excellent friend Dr. Schaum, to whom it is dedicated. This species has the form and sculpture of A. obliquata, but is smaller, with less convex elytral intervals, and only five dorsal punctures.

3. *Clivina* viridis Say; *Clivina rostrata* Dej.; *Ardistomis rostrata* Putzeys; *Ardistomis vicina* Putzeys.

ASPIDOGLOSSA Putz.

Of this genus is known to me but one species within our territory, A. subangulata *Lec.*, which however varies slightly in the form of the thoraz, so as to account for the list of synonyms, which are as follows:

Dyschirius subangulatus Chaud.; *Clivina crenata*‡Dej.; *Clivina bipustulata*‡ Say.; *Dyschirius humeralis* Chaud.; *Aspidoglossa vicina* Putzeys; *Aspidoglossa fraterna* Putzeys.

CLIVINA Latr.

A. Tibiæ intermediæ extrorsum versus apicem calcaratæ; clypeus ad latera lobatus; (elytra punctis dorsalibus pluribus.)

a. Femora antica versus apicem dentata; paronychio valde elongato.

§. Tibiæ anticæ longitudinaliter sulcatæ;

Thorace planiusculo, latitudine fere breviore;

·33, Capite puncto verticali distincto 1. corvina *Putz.*
·3, Capite puncto verticali obsoleto 2. confusa *Lec.*
·32, Thorace latitudine longiore, cylindrico; capite puncto verticali nullo 3. georgiana *Lec.*

(§§. Tibiæ anticæ haud impressæ;

(·30, 4. dentipes *Dej.*
(·35, 5. fissipes *Putz.*

b. Femora antica mutica, incrassata; paronychio elongato.

§. Vertex sulcatum;

·26, Capite lævi; tota rufa 7. impressifrons *Lec.*
·24, Capite punctulato; thorace lævi; tota rufa, depressiuscula 8. planicollis *Lec.*
·21, Capite thoraceque punctulatis; tota rufa 9. punctulata *Lec.*
·21, Capite thoraceque punctulatis; picea 10. punctigera *Lec.*

§§. Vertex haud sulcatum; caput thoraxque lævia;

·21, Vertice foveato; thorace angulis basalibus dentigeris; tota rufa, depressiuscula 11. rubicunda *Lec.*
·20, Vertice haud foveato; thorace angulis basalibus simplicibus; tota fusco-rufa 12. rufescens *Dej.*

B. Tibiæ intermidiæ extrorsum haud calcaratæ.

a. Clypeus ad latera lobatus; elytra punctis dorsalibus pluribus; femora antica subtus versus apicem profunde sinuata; paronychio elongato; (frons foveata;)

§. Elytris striis integris subtilius punctulatis;

·20, Tota rufa 13. rufa *Lec.*
·21, Rufa, sutura late nigricante 14. Randalli *Lec.*
(·19, Nigra antennis pedibusque testaceis, elytrorum margine externo suturaque extrema ferrugineis 15. analis *Putz.*
·24, Nigra, pedibus rufo-piceis, antennis rufis 16. americana *Dej.*

§§. Elytris striis postice obliteratis; nigræ, antennis rufis;

·18, Thorace quadrato, elytrorum striis postice paulo obliteratis 17. morula *Lec.*
·25—·21, Thorace ovato, elytrorum striis postice paulo obliteratis 18. cordata *Putz.*
(·32, Thorace globoso-ovato, elytrorum striis postice valde obliteratis 19. morio *Dej.*
·20, Thorace subquadrato, antice angustato, vage punctulato (paronychio breviusculo) 20. striatopunctata *Dej.*

b. Clypeus ad latera rotundatus; elytra punctis dorsalibus binis vel nullis; femora antica incrassata, subtus haud sinuata; paronychio brevi, vel nullo.

§. Vertex longitudinaliter sulcatum;

·21, Rufa, thorace elongato 21. ferrea *Lec.*

§§. Vertex haud vel vix obsolete sulcatum;

α. Tibiæ anticæ dente laterali unico, terminali rectangulariter flexo;

·20, Nigra, elytris maculatis; thorace vage punctulato; paronychio subtilissimo 22. convexa *Lec.*

β. Tibiæ anticæ dentibus lateralibus duabus, dente terminali sensim curvata;

·23—·30, Nigra elytris maculatis; thorace fere lævi; paronychio nullo 23. bipustulata *Dej.*
(·27, Nigra, elytrorum margine suturaque postica ferrugineis; thorace lævi 24. marginipennis *Putz.*
·21, Nigra elytris maculatis; thorace punctato; paronychio brevi 25. postica *Lec.*
·21, Nigra; sulco frontali transverso profundo; thorace vage punctato; paronychio brevi 26. picea *Putz.*
(·20, Nigra elytris maculatis; thorace lævi 27. stigmula *Putz.*

The species 1—3 are so closely related that they might perhaps be regarded, with some Mexican and South American forms, as races of one species; 4 and 5 perhaps may belong with them, but as Putzeys mentions particularly that the anterior tibiæ are not longitudinally impressed, I have retained them in the table.

8. C. planicolis. South Carolina, sent me by Dr. Zimmermann.

10. C. punctigera. Found with the preceding.

11. C. rubicunda. Louisiana, Dr. Schaum.

12. C. rufescens Dej. is perhaps C. pallida Say, but the color is darker than described by Say; none of the other species mentioned in the synopsis can be referred to Say's description; C. rubicunda has the proper color and form, but besides the lateral angle, the basal angles are tooth-like.

13. C. rufa. Illinois, Mr. Willcox.

14. C. Randalli. *Clivina elongata*‖Randall. The specimen is very imperfect, but seems most allied in sculpture to C. americana. The head is wanting.

16. C. americana Dej.; *Clivina acuducta* Hald., according to comparison with the type. This and the two species which follow it are very closely allied; the only differences observed are those mentioned in the table.

21. C. ferrea. Illinois, Mr. Willcox; Catskill, Mr. H. Ulke.

22. C. convexa is probably *C. bisignata* Putzeys, though the peculiar form of the terminal digitation of the anterior tibiæ is not mentioned.

23. C. bipustulata. *Scarites quadrimaculatus* Beauv.

C. picipes Bon.; Putzeys, 105, is probably not found in the United States. It is very different from any above mentioned.

Scarites attenuatus Herbst. Käfer, 10, 264, tab. 176, f. 7, is completely irrecognizable.

SCHIZOGENIUS Putz.

A. Mentum edentatum, lobis recte truncatis; elytra crenato-striata, interstitio 5to haud punctato;

·17, Nigro-rufus, cylindricus; elytris interstitio 3io tripunctato 1. crenulatus *Lec.*

B. Mentum medio dentatum, lobis oblique emarginatis; elytra interstitio 5to punctigero.

a. Elytra striis punctatis;

·19, Nigro-rufus, elytris subdepressis, striis dense punctatis 2. lineolatus *Lec.*
·16, Rufus, elytris cylindricis, striis minus profunde punctatis 3. ferrugineus *Putz.*

•15, Rufus, elytris valde depressis; thorace angulis ante basin prominulis 4. amphibius *Lec.*
‘16, Obscure rufus, elytris valde depressis; thoracis angulis haud prominulis 5. depressus *Lec.*
b. Elytra striis impunctatis;
•17, Rufo-niger, elytris subdepressis, interstitiis alternis multipunctatis setigeris 6. pluripunctatus *Lec.*

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2. *Clivina* lineolata Say; *Schizogenius sulcifrons* Putzeys.
3. S. ferrugineus Putzeys; *Clivina sulcata* Lec.
4. *Clivina* amphibia Hald.; *Clivina frontalis* Lec.
6. S. pluripunctatus Lec.; *S. simplex* Lec.

Description of Six New Species of UNIONES from Alabama.

BY ISAAC LEA.

UNIO PROPINQUUS. Testâ subnodulosâ, obliquâ, subtriangulari, valdè inæquilaterali, ad latere sulcatâ; valvulis crassis, anticè crassioribus; natibus erectis, tumidis; epidermide vel luteâ vel viridi, radiatâ; dentibus cardinalibus subgrandibus, in utroque valvulo duplicibus; lateralibus percrassis, crenulatis, curtis subcurvisque; margaritâ albâ et iridescente.

Hab. Florence, Alabama, Rev. G. White and Tuscumbia, Alab., L. B. Thornton, Esq.

UNIO FLORENTINUS. Testâ lævi, ellipticâ, subæquilaterali, ad latere paulisper planulatâ; valvulis crassis, anticè crassioribus; natibus tumidis, ad apices undulatis; epidermide luteo-olivaceâ, valdè radiatâ; dentibus cardinalibus submagnis, conicis, crenulatis, in utroque valvulo duplicibus; lateralibus curtis, subcurvisque; margaritâ albâ.

Hab. Florence, Alabama. Rev. G. White. Cumberland River, Tenn., Drs. Troost and Edgar, and T. C. Downie, Esq., St. Simon’s Island.

UNIO BIEMARGINATUS. Testâ lævi, triangulari, inæquilaterali, posticè biangulatâ, ad latere sulcatâ, ad basim et posticè emarginatâ; valvulis sub-crassis. anticè crassioribus; natibus prominentibus, compressis; epidermidè rufo-fuscâ valdè radiatâ; dentibus cardinalibus parvis, valdè crenulatis, sub-conicis, in utroque valvulo duplicibus; lateralibus curtis, crassis rectisque; margaritâ albâ et iridescente.

Hab. Florence, Alab. Rev. G. White.

UNIO MUNDUS. Testâ lævi, obliquâ, tumidâ, posticè subangulatâ, valdè inæquilaterali; valvulis crassis, anticè crassioribus; natibus valdè elevatis, tumidis, retrorsis; epidermide vel luteâ vel luteo-fuscâ, maculatâ; dentibus cardinalibus parvis, crenulatis, crompresso-conicis; lateralibus; sublongis, crassis subcurvisque; margaritâ albâ et iridescente.

Hab. Tuscumbia, Alab. L. B. Thornton, Esq.

UNIO THORNTONII. Testâ lævi, subrotundâ tumidâ, ad latere paulisper planulatâ, ad basim compressâ, valdè inæquilaterali, anticè et posticè rotundatâ; valvulis crassis; natibus valdè elevatis, tumidis, retrorsis; epidermide rufo-fuscâ, maculatâ; dentibus cardinalibus crassis crenulatisque; lateralibus percrassis subcurvisque; margaritâ albâ et iridiscente.

Hab. Tuscumbia, Alab. L. B. Thornton, Esq.

UNIO MOORESIANUS. Testâ lævi, subtriangalari, tumidâ, ad latere planulatâ, ad basim compressâ, posticè subangulatâ, valdè inæquilaterali; valvulis crassis, anticè crassioribus; natibus valdè elevatis, tumidis, retrorsis; epidermide rufo-fuscâ, maculatâ; dentibus cardinalibus crassis, obtuso-conicis, crenulatis, in utroque valvulo duplicibus; lateralibus crassis subrectisque; margaritâ albâ et iridescente.

Hab. Tuscumbia, Alabama. H. Moores.

Description of Eight New Species of NAÏADES from various parts of the United States.

BY ISAAC LEA.

Unio pinguis. Testâ lævi, ellipticâ, inflatâ, valdè inæquilaterali; valvulis subcrassis; natibus prominentibus, retrorsis; epidermide luteâ, obscurè radiatâ et politâ; dentibus cardinalibus submagnis, duplicis, acuminatis crenulatisque; lateralibus magnis, lamellatis longis curvisque; margaritâ albâ et indescente.
Hab. St. Peter's River, Upper Mississippi. B. W. Budd, M.D.

Unio Higginsii. Testâ lævi, obliquâ, ventricosâ, valdè inæquilaterali, anticè rotundatâ; valvulis percrassis; natibus valdè prominentibus, tumidis incurvisque; epidermide virido-olivâ, politâ, valdè radiatâ; dentibus cardinalibus magnis, crassis, erectis, crenulatis, in utroque valvulo duplicibus; lateralibus sublongis, percrassis subrectisque; margaritâ vel albâ vel salmonis colore tinctâ.
Hab. Muscatine, Iowa. Frank Higgins.

Unio Abbevillensis. Testâ lævi, oblongâ, subinflatâ, ad lateris planulatis, valdè inæquilaterali, posticè biangulatâ; valvulis crassis; natibus prominulis; epidermide brunneâ, striatâ; dentibus cardinalibus magnis, crassis, in utroque valvulo duplicibus; lateralibus prælongis, lamellatis subcurvisque; margaritâ vel albâ vel salmonis colore tinctâ.
Hab. Abbeville District, South Carolina. Dr. Barratt.

Unio Jamesianus. Testâ lævi, ellipticâ, compressâ, valdè inæquilaterali, posticè valdè compressâ ad basim emarginatâ; valvulis subcrassis; natibus prominulis, ad apicem concentraliter undulatâ; epidermide luteâ, politâ; dentibus cardinalibus compressis, crenulatis; lateralibus longis, lamellatis valdé curvisque; margaritâ albâ et iridescente.
Hab. Jackson, Mississippi. U. P. James.

Unio Texasiensis. Testâ lævi, ellipticâ, subcompressâ, valdè inæquilaterali, posticè subangulatâ; valvulis subtenuibus, anticè crassioribus; natibus prominulis, ad apices pereleganter et concentricè undulatis; epidermide tenebroso-olivâ, politâ, obsoletè radiatâ; dentibus cardinalibus parvis, compressis, erectis crenulatisque; lateralibus longis, lamellatis subcurvisque; margaritâ cœruleâ et valdè iridescente.
Hab. Dewitt County, Texas. W. Newcomb, M. D.

Anodonta Lewisii. Testâ lævi, ellipticâ, subventricosâ, inæquilaterali, posticè obtusè angulatâ, anticè rotundatâ; valvulis subtenuibus; natibus prominulis, ad apices rugoso-undulatis; epidermide tenebroso-olivaceâ, eradiatâ; margaritâ cœruleo-albâ et iridescente.
Hab. Erie Canal and Mohawk River, Herkimer Co., N. Y. James Lewis, M. D.: and Genesee River, below Rochester. Prof. C. Dewey.

Anodonta lacustris. Testâ lævi, transversâ, subinflatâ, valdè inæquilaterali posticè subangulatâ; valvulis tenuibus; natibus prominulis, ad apices crebri undulatis; epidermide luteo-olivaceâ, eradiatâ, transversè vittatâ; margaritâ vel albâ vel croceâ et iridescente.
Hab. Crooked Lake and Little Lakes, New York. James Lewis, M. D.

Anodonta modesta. Testâ lævi, ellipticâ, subinflatâ, valdè inæquilaterali, subemarginatâ, anticè obtusè angulatâ; valvulis subcrassis, posticè crassioribus; natibus subprominentibus, ad apices undulatis; epidermide olivaceâ, transversè vittatâ et obsoletè radiatâ; margaritâ argenteâ et valdè iridescente.
Hab. Pond near Kalamazoo, Mich. J. Lewis M. D.

Description of Three New Exotic species of NAÏADES.

BY ISAAC LEA.

Unio Poeyanus. Testâ lævi, transversâ, subcylindraceâ, ad basim subemarginatâ, valdè inæquilaterali, ad latere planulatâ, posticè truncatâ et subbiangulatâ ; valvulis subcrassis ; natibus prominulis, ad apices simplicibus ; epidermide luteolâ; dentibus cardinalibus subcompressis, accuminatis crenulatisque ; lateralibus prælongis, lamellatis rectisque ; margaritâ luteolâ et iridescente.

Hab. Rio de las Balsas, near Coyucan, Mexico. Prof. Poey of Havanna.

Unio Canadensis. Testâ lævi, triangulari, subcompressâ, inæquilaterali, posticè obtusè angulatâ ; valvulis subcrassis, anticè crassioribus; natibus subprominentibus ; epidermide luteâ, posticè radiatâ ; dentibus cardinalibus parvis, erectis crenulatisque ; lateralibus longis, curvis lamellatisque ; margaritâ albâ et iridescente.

Hab. St. Lawrence River, near Montreal. M. Carey Lea.

Anodonta Holtonis. Testâ lævi, oblongâ, inflatâ, valdè inæquilaterali, e natibus lineatis ; valvulis subcrassis ; natibus subprominentibus ; epidermide tenebroso-olivaceâ, striatâ ; margaritâ cœruleâ et iridescente.

Hab. Near Cauca River, Province of Popayan, S. A. Rev. J. F. Holton.

Description of Twelve New Species of NAÏADES from North Carolina.

BY ISAAC LEA.

Unio Wheatleyi. Testâ lævi, quadratâ, subinflatâ, ad latere planulatâ, subemarginatâ, valdè inæquilaterali ; valvulis subcrassis ; natibus prominulis ; epidermide tenebroso-fuscâ ; dentibus cardinalibus curtis, subcrassis, in utroque valvulo duplicibus ; lateralibus subcrassis, prælongis subrectisque ; marginatâ vel albâ vel purpureâ et iridescente.

Hab. Catawba River, Gaston Co., N. C. C. M. Wheatley.

Unio percoarctatus. Testâ lævi, quadratâ, valdè coarctatâ ad latere planulatâ valvulis tenuibus, posticè subbiangulatâ ; natibus vix prominentibus, ad apices undulatis ; epidermide tenebroso-fuscâ, minutè et valdè striatâ ; dentibus cardinalibus parvis, striatis, in utroque valvulo duplicibus ; lateralibus prælongis, lamellatis rectisque ; margaritâ purpureâ et valde iridescente.

Hab. Catawba River, Gaston Co., N. C. C. M. Wheatley and F. A. Genth, M. D.

Unio gracilentus. Testâ lævi, valdè transversâ, valdè compressâ, ad latere planulatâ, valdè inæquilaterali, posticè obtusè angulatâ ; valvulis tenuibus ; natibus vix prominentibus, ad apices undulatis ; epidermide tenebroso-fuscâ, posticè obsoletè radiatâ ; dentibus cardinalibus parvis, crenulatis, in utroque valvulo duplicibus ; lateralibus prælongis, lamellatis rectisque ; margaritâ cœruleo-albâ et valdè iridescente.

Hab. Catawba River, Gaston Co., N. C. C. M. Wheatley.

Unio micans. Testâ lævi, ellipticâ, subcompressâ, valdè inæquilaterali, postice angulatâ ; valvulis subtenuibus, posticè crassioribus ; natibus prominulis ; epidermide luteo-fuscâ, valdè radiatâ et valdè micante ; dentibus cardinalibus parvis, compressis, erectis crenulatisque ; lateralibus longis, lamellatis rectisque ; margaritâ vel albâ vel salmonis colore tinctâ et valde iridescente.

Hab. Catawba River, Gaston Co., N. C. C. M. Wheatley and F. A. Genth, M. D. Deep River Gulf, N. C. Prof. Emmons.

Unio Genthii. Testâ lævi, obliquâ, inflatâ, inæquilaterali, posticè obtusè angulatâ ; valvulis subcrassis, anticè crassioribus ; natibus prominentibus ; epidermide tenebroso-fuscâ, obsoletè radiatâ ; dentibus cardinalibus subgrandibus, obtusè conicis crenulatisque; lateralibus crassis, curtis rectisque; margaritâ albâ et iridescente.

Hab. Catawba River, Gaston Co., N. C. C. M. Wheatley and F. A. Genth, M. D. Deep River Gulf, N. C. Prof. Emmons.

Unio Emmonsii. Testâ lævi, transversâ subcompressâ, valdè inæquilaterali, posticè subbiangulatâ, ad latere planulatâ; valvulis subcrassis; natibus vix prominulis, ad apices undulatis, epidermide tenebroso-fuscâ, radiatâ, nitidâ; dentibus cardinalibus subgrandibus, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus prælongis, lamellatis rectisque; margaritâ albâ et iridescente.

Hab. Roanoke River, at Weldon, N. C. Prof. E. Emmons.

Unio spadiceus. Testâ lævi, ellipticâ, subcompressâ, inæquilaterali, posticè subbiangulatâ subemarginatâ; valvulis subtenuibus, anticè crassioribus; natibus vix prominulis; epidermide spadiceâ, eradiatâ; dentibus cardinalibus parvis crenulatisque; lateralibus sublongis subrectisque; margaritâ salmonis colore tinctâ et iridescente.

Hab. Deep River, Gulf, N. C. Prof. Emmons: and mountain streams, N. C. Joseph Clark.

Unio insulsus. Testâ lævi, quadratâ, inflatâ, inæquilaterali, posticè obtusè angulatâ, at laterè subplanulatâ; valvulis subcrassis; natibus prominulis, ad apices rugoso-undulatis; epidermide virido-fuscâ, insulse, striatâ, obsoletè radiatâ; dentibus cardinalibus parviusculis, subcompressis, in utroque vavulo duplicibus; lateralibus sublongis subcurvisque; margaritâ vel albâ vel purpureâ et iridescente.

Hab. Roanoke River, Weldon, N. C. Prof. Emmons.

Unio striatulus. Testâ lævi, triangulari, subinflatâ, subæquilaterali, posticè angulatâ; valvulis subcrassis, anticè crassioribus; natibus elevatis, accuminatis, ad apices rugoso-undulatis; epidermide fuscâ, minutè striatâ, obsoletè radiatâ; dentibus cardinalibus parvulis, subcompressis in utroque valvulo duplicibus crenulatisque; lateralibus brevibus, subcrassis rectisque; margaritâ vel albâ vel croceâ et iridescente.

Hab. Roanoke River, at Weldon N. C. Prof. Emmons.

Unio macer. Testâ alatâ, lævi, obovatâ, compressissimâ, valdè inæquilaterali, posticè biangulatâ; vulvulis tenuibus; natibus parvis, acuminatis, ad apices undulatis; epidermide fuscâ, nitidâ, valdè radiatâ; dentibus cardinalibus parvis, tuberculatis; lateralibus prælongis, attenuatis, lamellatis subrectisque; margaritâ purpureâ, et iridescente.

Hab. Roanoke River, Weldon, N. C. Prof. Emmons.

Unio contractus. Testâ lævi, ellipticâ, valdè compressâ, valdè inæquilaterali, posticè rubrotundatâ; valvulis tenuibus; natibus depressis, ad apices undulatis; epidermide tenebroso-fuscâ, obsoletè radiatâ; dentibus cardinalibus parvis, tuberculatis; lateralibus longis, lamellatis rectisque; margaritâ vel albâ vel purpureâ et iridescente.

Hab. Roanoke River, Weldon, N. C. Prof. Emmons.

Anodonta virgulata. Testâ lævi, ellipticâ, ventricosâ, inæquilaterali, posticè obtusè angulatâ; valvulis subtenuibus; natibus prominulis, ad apices undulatis; epidermide vittata, virido-radiatâ; margaritâ cœruleo-albâ et iridescente.

Hab. Roanoke River, Weldon, N. C. Prof. Emmons: and Washington Co., Georgia. Rev. G. White.

Contributions to the Neuropterology of the United States. No. 1.

BY P. R. UHLER.

NANNOPHYA Rambur.

N. bella. Black, pleura and sides marked with yellow; wings with a saturate pale-ferruginous spot at base enclosing a number of round dots of a darker color.

Length ¾ inch. Baltimore. June.

♀. Trophi blackish, front white with a large black spot upon the middle, vertex blue, eyes brown, antennæ black: thorax black with a yellow vitta upon the pleura becoming posteriorly confluent with patches of the same color, interalary surface maculate with yellow: wings hyaline, a broad, saturate yellowish-ferruginous spot at base occupying about one-third of their surface and enclosing a number of small round dots of a deeper color; pterostigma small, black: legs black, spiny: abdomen black annulated with yellow, caudal tip and appendages also yellow.

This beautiful little species, the second only of the genus yet known, differs a little from the type and must be placed in a division which may be characterized by having two ranges of discoidal areolets. It is very rare and the male is yet unknown to me.

LIBELLULA Lin.

1. L. bistigma. Lead-blue; wings with a ferruginous tint upon the costal margin, stigma brown and white.

Length 2 inches. Baltimore. June and July.

♂. Body entirely lead blue; eyes brown, trophi dusky; frontal and vertical vesicles dark blue, antennæ black, stemmata brownish: thorax medially with a deep longitudinal depression, a sharp carina occupying the middle: wings lacteo-hyaline, costal margins slightly tinged with ferruginous, sometimes extending narrowly upon the tips, stigma bicolored, half brown and half white, membranes narrow, whitish: legs black, anterior ones dusky at base: abdomen trigonal, carinate, tapering towards the tip, cerci subfusiform, sub-acute.

The female of this species I have not yet been able to discover, notwithstanding it is here very common; I was tempted to suppose it to be a geographical variety of the species following: however as I have not yet heard that doctrine fully elucidated it seems hardly prudent for me to venture any further suggestions upon the subject.

2. L. plumbea. Lead color; pleura with two white spots; wings with a tinge of ferruginous upon the costal margin.

Length 2 inches. Baltimore. July.

♂. Body plumbeous: labium, base of mandibles, and sides of nasus and front white; mandibles at tip, labrum, nasus, front and antennæ black; frontal and vertical vesicles dark blue, eyes brown, occiput with two yellow spots behind each eye: pleura each with two common white patches, which are divided by black sutures, dorsolum and metapnystega also white, dorsal middle longitudinally depressed, but slightly carinated: wings hyaline with a ferruginous tinge upon the costal margin, stigma long, brown: abdomen gradually tapering posteriorly, carinate, first and second segments white beneath, caudal segment and appendages black, cerci fusiform, sub-acute.

♀. Body pale brown; head, dorsal line, line between the wings, pleural spots, pectus, sides of tergum and femora, testaceous-yellow; eyes brown, antennæ black: costal margins and tips of the wings ferruginous: abdomen subdepressed, tergum with a gradually dilating brown line upon the middle, antepenultimate segment broadly dilated.

3. L. confusa. Fuscous; thorax with two oblique yellow lines upon the pleura, connected with each of which is a pale trigonal spot; wings with a brown basal line, and medial and apical spot.

Length 1¾ inches. Baltimore and Boston.

♀. Fuscous: head, with the frontal vesicles above, labium and spots upon the occiput yellow, antennæ and connecting line black, eyes brown: pleura with two oblique yellow lines bounding inferiorly a trigonal pale spot, a pale transverse line between the pairs of wings: wings hyaline, at the base a longitudinal line, a spot upon the anterior middle, and another upon the apex, brown, nervules of the spots and intervening surface yellow, pterostigma black: legs pale at base, black upon the tip of the femora and tibiæ: abdomen brownish, a little depressed, antepenultimate segment a little dilated, a dark line upon the middle, and one each side bright yellow, venter lined with yellow each side, cerci short, subfusiform, acute, inferior appendage same length as cerci.

♂. Differs but little from the ♀ in size and coloring; it may be distinguished from L. pulchella, Drury,—to which it is very closely allied—in the lateral yellow vitta and much larger size of the ♀: the male always wants the plumbeous abdomen, which is common to L. pulchella.

4. L. saturata. Reddish yellow; head ——; thorax dark yellowish-red, pale beneath and upon the sides; wings humeral portion saturate reddish-yellow, cubital portion hyaline, nervules red, pterostigma red, margined anteriorly and posteriorly by a black nervule; legs rufous, pale at base, tibial spines black; abdomen slightly dilated, carinate, trigonate, lateral edge and denticles black; cerci subfusiform, acuminate, armed with a row of minute tubercles upon the inferior surface, inferior caudal appendage oval, tapering at tip and emarginate.

Length 2 inches. San Diego trip. Dr. T. H. Webb.

This species is indicated by a mutilated individual only; the head and a great part of the wings and legs are gone, and those parts remaining are in so bad a condition as to render it almost uncharacterizable. It apparently belongs to a group having five rows of discoidal areolets; the triangle is crossed by four nervules.

5. L. Julia. Fuscous, pubescent; eyes brown, darker below, tips of mandibles, line between the antennæ, antennæ and pubescence upon the front black, front and occipital spots yellowish; thorax with the superior, middle-surface and pleura pale fuscous, humerus with a dark-brown longitudinal line; wings hyaline, posterior pair with a trigonal dark-brown spot at base of each, necks of anterior pair tinged with brown, nervules and pterostigma dark-brown, the latter narrow and a little elongated, membranes narrow whitish; legs with the coxæ, trochanters and bases of femoræ pale reddish-yellow, tibiæ and tarsi blackish; abdomen sub-depressed, slightly carinate above, line upon the middle of the posterior segments and lateral margin black, caudal appendages yellow, cerci short, subfusiform, minutely, serially, granulate beneath.

Length 1½ inches. Fort Steilacoom, W. Territory. Dr. Suckley.

A species very closely allied to L. trimaculata *De Geer*. It possesses three ranges of discoidal areolets, and the triangle is crossed by only one nervule.

6. L. assimilata. Pale-yellow; head yellowish-testaceous, a black line covering the antennal suture, tips of mandibles and antennæ black, front and vertex closely covered with blackish hair; thorax densely pubescent, pectus pale-testaceous; wings hyaline, tinted with yellow upon the base and humeral margin, costal nervule dotted with minute, black points, pterostigma yellow, margined anteriorly and posteriorly, by a black nervule; legs black, coxæ, trochanters and inferior surface of the anterior legs, yellowish; abdomen, almost transparent, yellowish, cerci ———.

Length 1½ inches. Fort Union, Nebraska. Dr. Suckley

The three individuals, the only ones that I have had the opportunity of examining, are in such a mutilated condition as to render it very difficult to characterize them properly; enough, however, remains to indicate their distinctness from all the other species that have yet been noticed.

They have three ranges of discoidal areolets to the primary wings, and the triangle is crossed by a single nervule.

The three foregoing insects wère kindly placed in my hands by Dr. Chas. Girard, to whom I would embrace this opportunity of returning my thanks.

List of Extinct VERTEBRATA, the remains of which have been discovered in the region of the Missouri river: with remarks on their Geological Age.

BY JOSEPH LEIDY, M. D.

I. *MAMMALIA.*

RUMINANTIA.

1. Oreodon Culbertsonii, Leidy: Ancient Fauna of Nebraska 45. Synonymes, *Merycoidodon Culbertsonii*, *Oreodon priscus*, *Cotylops speciosa.*
2. Oreodon gracilis, L.: Ibid. 53. Syn. *Merycoidodon gracilis.*
3. Oreodon major, L.: Ibid. 55; Proc. Acad. Nat. Sci. viii. 164. Syn. *Merycoidodon major.*
4. Agriochoerus antiquus, L.: Anc. Fauna Nebr. 24. Syn. *? Eucrotaphus Jacksoni.*
5. Agriochoerus major, L.: Proc. Acad. Nat. Sci. viii. 164. Syn. *?Eucrotaphus auritus.*
6. Poebrotherium Wilsoni, L. Anc. F. Nebr. 19.
7. Leptomeryx Evansi, L.: Pr. A. N. S. vi. 394.
8. Leptauchenia decora, L.: Ibid. viii. 88.
9. Leptauchenia major, L.: Ibid, 163.
10. Protomeryx Halli, L.: Ibid. 164.
11. Merycodus necatus, L.: Ibid, vii. 90.
12. Camelops kansanus, L.: Jour. A. N. S. iii. 166.

MULTUNGULA.

13. Choeropotamus (Hyopotamus) americanus, L: Pr. A. N. S. viii. 59.
14. Entelodon Mortoni, L.: Anc. F. Nebr. 57. Syn. *Archæotherium Mortoni*, *A. robustum*, *Arctodon.*
15. Entelodon ingens, L.: Pr. A. N. S. viii. 164.
16. Titanotherium Proutii, L.: Anc. F. Nebr. 72; Pr. A. N. S. viii. 92. Syn. *Palæotherium* Cuv. Prout; *P? Proutii*, Owen, Norwood, and Evans; *Rhinoceros ? americanus; Eotherium americanum*, and *Palæotherium giganteum*, Leidy.
17. Palaeochoerus probus, L.: Pr. A. N. S. viii. 164.
18. Leptochoerus spectabilis, L.: Ibid. 88.
19. Rhinoceros occidentalis, L.: Anc. F. Neb. 81. Syn. *Aceratherium..*
20. Rhinoceros (Hyracodon) nebrascensis, L.: Pr. A. N. S. viii. 92. Syn. *Aceratherium nebrascense.*
21. Mastodon ohioticum. *Small fragments of molar teeth.*

SOLIDUNGULA.

22. Hipparion occidentale, L.: Pr. A. N. S. vii. 59.
23. Hipparion speciosum, L.: Ibid. viii. 311. Syn. *?Hippodon speciosus*, Ibid. vi. 90.
24. Anchitherium Bairdii, L.: Anc. F. Nebr. 67. Syn. *Palæotherium Bairdii.*
25. Merychippus insignis, L.: Pr. A. N. S. viii. 311.

RODENTIA.

26. Steneofiber nebrascensis, L.: Pr. A. N. S. viii. 89.
27. Ischyromys typus, L.: Ibid.
28. Palaeolagus Haydeni, L.: Ibid.
29. Eumys elegans, L.: Ibid: 90.

PINNIPEDIA.

30. Ischyrotherium antiquum, L.: Pr. A. N. S. viii. 89.

CARNIVORA.

31. Hyaenodon horridus, L.: Pr. A. N. S. vi. 393.
32. Hyaenodon cruentus, L.: Ibid.
33. Hyaenodon crucians, L.: Ibid.
34. Amphicyon vetus, L.: Ibid. vii. 157. Syn. *Daphœnus vetus.*
35. Amphicyon gracilis, L.: Ibid. viii. 90.
36. Machairodus primaevus, L. and Owen: Anc. F. Neb. 95.
37. Deinictis felina, L.: Pr. A. N. S. vii. 127; viii. 91.
38. Leptarctus primus, L.: Ibid. viii. 311.

II. *REPTILIA.*

CHELONIA.

39. Testudo nebrascensis, L.: Anc. F. Neb. 103. Syn. *Stylemys nebrascensis, ?Emys* seu *Testudo hemispherica, Oweni, Culbertsonii,* et *lata.*
40. Trionyx foveatus, L.: Pr. A. N. S. viii. 73, 312.
41. Compsemys victus, L.: Ibid, 312.
42. Emys obscurus, L.: Ibid.

SAURIA.

43. Mososaurus missouriensis, Leidy. Syn. *Ichthyosaurus missouriensis,* Harlan; *Mososaurus Maximiliani,* Goldfuss; etc.
44. Megalosaurus? (Deinodon) horridus, L.: Pr. A. N. S. viii. 72.
45. Palaeoscincus costatus, L.: Ibid.
46. Trachodon mirabilis, L.: Ibid.
47. Troodon formosus, L.: Ibid.
48. ?Crocodilus humilis, L.: Ibid. 73.
49. Thespesius occidentalis, L.: Ibid. 311.

III. *PISCES.*

50. Clupea humilis, L.: Pr. A. N. S. viii. 256.
51. Cladocyclus occidentalis, L.: Ibid.
52. Enchodus Shumardi, L.: Ibid.
53. Saurocephalus lanciformis, Harlan: Jour. Ac. Nat. Sc. iii. 337; Med. & Phys. Res. 362.
54. Lepidotus occidentalis, L.: Pr. A. N. S. viii. 73.
55. Lepidotus Haydeni, L.: Ibid.
56. Mylognathus priscus, L.: Ibid. 312.

Of the above list of vertebrate remains those of *Mososaurus, Cladocyclus, Enchodus,* and *Saurocephalus* were obtained from deposits of the cretaceous period.

The remains of *Deinodon, Palæoscincus, Trachodon, Troodon, ?Crocodilus,* and *Lepidotus,* were discovered by Dr. F. V. Hayden, in a deposit, on the Judith River, which I have suspected to be of equivalent age with the Wealden formation of Europe.

The remains of *Compsemys, Emys,* and *Mylognathus,* were found at Long Lake, Nebraska, together with those of *Trionyx,* the same species of which appears also to be common to the deposit just mentioned of the Judith River.

Oreodon, Agriochœrus, Pœbrotherium, Leptomeryx, Leptauchenia, Protomeryx, *Merycodus*, *Titanotherium*, *Leptochœrus*, *Hyracodon*, *Merychippus*, *Ischyromys*, *Palæolagus*, *Eumys*, *Deinictis*, and *Leptarctus* are peculiar, extinct, mammalian genera, from the tertiary formations of Nebraska, which have heretofore been generally viewed as belonging to the eocene period, but which from their affinities, from the associated genera, and the absence of others so common in the eocene deposits of Europe, I suspect rather to belong to the miocene period. The first seven genera, above mentioned, are true ruminants, with the teeth constructed upon the same type as those of living ruminants;—a type which is not found in the tertiary deposits of Europe and Asia earlier than the miocene period.

Entelodon, *Palæochœrus*, *Rhinoceros*, *Hipparion*, *Steneofiber*, *Amphicyon*, and *Machairodus*, are common to the Nebraska tertiary deposits and to the miocene and later tertiary deposits of Europe; and they have not been found in the eocene formations of the latter continent.

Of the genera *Anchitherium*, *Hyopotamus*, and *Hyænodon*, species are found common to the Nebraska tertiary deposits and the European eocene and miocene deposits.

Remains of *Palæotherium*, *Anoplotherium*, and *Lophiodon*, so common in the eocene formations of Europe, are entirely absent from the Nebraska tertiary formations.

Titanotherium of Nebraska most nearly approaches the miocene *Chalicotherium* of Europe and Asia.

The Nebraska rodents *Ischyromys*, *Palæolagus*, and *Eumys* most closely approach the *Arctomys*, *Lepus*, and *Mus* of European miocene and later deposits.

Very numerous remains of *Testudo* are found in association with the Nebraska tertiary mammals; and extinct species of the same genus belong generally to the miocene and later deposits of Europe.

The remains of *Mastodon* and *Camelops* mentioned in the the list, I suspect to belong to the post pliocene age of the upper Missouri country.

Ischyrotherium appears to be an animal allied to the *Manatus*. Its remains are stated by Dr. Hayden to have been obtained from a lignite bed (miocene*) near Moreau and Grand rivers; but I must leave it to this indefatigable explorer to determine whether it belongs to the same age as the numerous extinct terrestrial mammals of Nebraska.

Thespesius I suspect to be a huge dinosaurian. Its remains are stated to belong to the lowest member of the lignite formations (miocene) of Grand River.

The species of *Clupea* was discovered by Dr. John Evans, in a tertiary deposit on Green River, Missouri; but the exact age of this formation I have no means of determining.

Investigation on the Rock Guano from the Islands of the Caribbean Sea.

BY WM. J. TAYLOR.

Though much has been written and published on the Columbian Guano of the Caribbean Sea, which is also termed Phosphatic Guano, native Super-Phosphate of Lime, &c., I have considered the subject not entirely exhausted, and have for some time past been paying especial attention to its composition, and have also endeavored to gather all possible information regarding its occurrence. To Dr. D. Luther, President of the Philadelphia Guano Company, I am particularly indebted, for his kindness in furnishing me with material for the investigation from the various groups of islands, and for information regarding its occurrence. To Dr. F. A. Genth I am also indebted for allowing me to make the investigation in his laboratory. The Guano rock is found on Islands N. E. and N. of the coast of Venezuela in the Caribbean Sea, and belonging to that Republic; the islands form groups or keys composed of one hundred or more small islands, inhabited principally and indeed almost solely, by water fowl, who resort there in immense numbers for laying their eggs. Mr. Cassin informs me that the birds are those commonly known as Gulls, Pelicans, and Cormorants; these have been the instruments by which the immense deposits of Guano have been formed. But what the process has been is a problem not yet fully solved.

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* Proc. Acad. Nat. Sci. viii. 268.

The Columbian Guano is a hard rock, consisting of two distinct portions; the outer exterior crust, consisting of a white, frequently reniform coating, which in places where it is not decomposed has a polished surface not unlike enamel; it is composed of concentric layers, each of which is about two or more lines in thickness. The entire outer crust forms but a very small proportion of the whole rock; a carefully selected portion of this has been analyzed, which had not undergone any apparent decomposition, and upon which the enamelled surface was well preserved. In some portions the reniform surface is distinctly marked, and it resembles to a certain extent in its appearance the menilite from Menil Montant near Paris; the concentric layers composing it are well marked, and when they are fractured or cut across, an appearance is presented not unlike some varieties of agate.

The following is the result of analysis:—

(I).

2.0266	grammes	ignited lost	0.1640	grammes	gave	13.03	per cent.
"	"	Ag	0.0274	"	Chlorine	0.44	" "
"	"	CaO, SO_3	0.0419	"	Sulphuric acid	1.93	" "
"	"	CaO, SO_3	1.9965	"	Lime	40.64	" "
"	"	$2MgO, PO_5$	0.1654	"	Magnesia	2.93	" "
"	"	$2MgO, PO_5$	1.1753	"	Phosphoric acid	37.15	" "
"	"	Residue	0.0111	"	Residue	0.55	" "
"	"	Na Cl	0.1231	"	Soda	3.23	" "

Loss by ignition,	13.03 per cent.	Oxygen ratio,	
Chlorine,	0.44 " "	" "	
Sulphuric Acid,	1.93 " "	" "	1.15
Phosphoric Acid,	37.15 " "	" "	20.82
Lime,	40.64 " "	" "	11.55
Magnesia,	2.93 " "	" "	1.17
Soda,	3.23 " "	" "	0.82

From the oxygen ratio of this it appears that the Phosphoric Acid and Lime exist in the proportion of $3CaOPO_5$. The crucible after ignition showed indications that Chloride of Iron had been volatilized.

Below this exterior crust the rock has a varied appearance; it is of a dark brown color, in places quite black, varying in others to a lighter shade, in which portion are frequent cavities filled with minute crystals of gypsum, readily recognizable with a pocket lens. The darkest portion is the most solid, with a slightly vitreous lustre, and of a much greater tensibility and hardness than any other portion of the guano; it has a sub-concoidal fracture, sometimes splitting into thin fragments, which are translucent, through some portions of it I have observed frequently, thin irregular bands, 1-32d to 1-16th of an inch in width, which has the appearance of carbon.

This portion was selected for analysis with particular care, with the view to ascertain its exact composition; it was with difficulty reduced to the finest powder and treated with distilled water (in the cold) in a beaker glass, being frequently stirred for several days in order that the water should be in frequent contact with the particles; it was then collected on a weighed filter and washed with cold water until the filtrate showed no trace of Sulphuric Acid; the excess of filtrate was evaporated to dryness, and a thorough analysis made of it, the result of which is the following:—

(II).

3.9922 grammes	0.3836 grams.	BaO, SO_3	gave	Sulphuric Acid	3.30
" "	0.1761 "	$CaOCO_2$	"	Lime	2.48
" "	0.0099 "	Ag	"	Chlorine	0.08
" "	0.0531 "	$2MgO, PO_5$	"	Phosphoric Acid	0.85
" "	0.0089 "	Na Cl	"	Soda	0.88

Per centage	Sulphuric Acid,	3.30	Oxygen ratio,	1.97
" "	Phosphoric Acid,	0.85	" "	0.54
" "	Lime,	2.48	" "	0.70
" "	Soda,	0.88	" "	0.22
" "	Chlorine,	0.08	" "	

There was in this analysis a loss of Lime or Magnesia, also, of the insoluble residue.

Selections were made from other specimens which resembled very nearly that above described, it was treated in the same manner as (II.), but the results show a marked difference, there being a smaller percentage of Phosphate of Lime dissolved from (II.) than from (III.) and a proportional amount of Chloride of Sodium. To this fact I shall again refer.

The following is the result of analysis :

(III.)

The residue before weighing was carefully dried at 100° C.

2.7271 grammes left, residue of 2.3177 gram.					84.98
" "	0.0095 grams.	Ag	gave	Chlorine,	0.11
" "	0.3603 "	BaO, SO_3	"	Sulphuric Acid,	4.91
" "	0.2536 "	CaO, SO_3	"	Lime,	3.84
" "	0.0083 "	$2MgO, PO_5$	"	Magnesia,	0.11
" "	0.0600 "	$2MgO, PO_5$	"	Phosphoric Acid,	1.58
" "	0.0201 "	Na Cl	"	Soda,	0.40

Chlorine,	0.11	per cent.	Oxygen ratio,	
Sulphuric Acid,	4.91	" "	" "	2.94
Phosphoric Acid,	1.58	" "	" "	0.88
Lime,	3.84	" "	" "	1.09
Magnesia,	0.11	" "	" "	0.04
Soda,	0.40	" "	" "	0·10

From another portion of the rock the black portion were selected for analysis, the quantity of sulphate of lime is very inconstant. The result of analyses were as follows:

(IV.)

0.9170 grammes,	.0536 gram.	BaO, SO_3	gave	Sulphuric Acid,	2.01 per ct.
" "	0.0510 "	CaO, CO_2	"	Lime,	3.13 "
" "	0.1532 "	Fe_2O_3	"	Sesquioxide of Iron,	16.71 "
" "	0.1123 "	Al_2O_3	"	Alumina,	12.25 "
2.0741 grams. lost by heating,	0.3254				15.69 "
" " insoluble residue,	0.1314				6.13 "

Owing to an accident to the platinum crucible just before weighing, the Phosphoric Acid, was not determined.

Sulphuric Acid,	2.01	per cent.	Oxygen ratio,	1.20
Lime,	3.13	“ “	“ “	0.89
Sesquioxide of Iron,	16.71	“ “	“ “	5.00
Alumina,	12.25	“ “	“ “	5.70

The specimens from which the material for the above analyses were selected, I received from Messrs. Richards & Miller, agents for the Philadelphia Guano Company; there is doubt as to their exact locality; in appearance they correspond exactly with that from Monk's Island, but the results of the analyses are very different from those obtained from the specimens from this Island which I received from Dr. Luther.

That Alumina is present as a phosphate, in the Guano from Monk's Island, I have proved, by treating 3.4023 grammes of an average sample of the cargo of Schr. Trident from Monk's Island, with pure Caustic Potash in a silver dish, and was found to contain 1.32 per cent. of Alumina.

Specimens were given me from Monk's Island by Dr. Luther, the characteristic appearance of which has already been described.

1.5915 grammes were treated in a silver dish with Potash, but not a trace of Alumina could be detected; the residue dissolved in Hydrochloric Acid was found to contain Lime, 39.08 per cent.

The guano rock from Monk's Island when finely powdered and treated with distilled water, gave an acid reaction with litmus paper.

(V.)

1.7076 gammes (organic matter and water not determined.)

“	“	0.1993 gram.	BaO, SO_3	gave	Sulphuric Acid,	4.00	per cent.
“	“	0.0780 “	$2MgO, PO_5$	“	Magnesia,	1.64	“ “
“	“	1.1999 “	CaO, CO_2	“	Lime,	39.34	“ “
“	“	1.1461 “	$2MgO, PO_5$	“	Phosphoric Acid,	42.98	“ “

Sulphuric Acid,	4.00	per cent.	Oxygen ratio,	2.39
Magnesia,	1.64	“ “	“ “	0.65
Lime,	39.34	“ “	“ “	11.10
Phosphoric Acid,	42.98	“ “	“ “	24.09

For the Oxygen of the Sulphuric Acid 2.39 there are required, 0.88 of the oxygen of the lime, and if to the remainder be added the Oxygen of the Magnesia we have 10.95, which is to the Oxygen of the Phosphoric Acid very nearly as 1 : 2

(VI.)

2.8678 grammes treated with distilled water gave :

“	“	2.7076 grams.	residue,			94.41	per cent.
“	“	0.1287 “	BaO, SO_3	gave	Sulphuric Acid,	1.49	“ “
“	“	0.0655 “	CaO, CO_2	“	Lime,	1.27	“ “
“	“	0.0363 “	$2MgO, PO_5$	“	Phosphoric Acid,	0.81	“ “

2.8426 grammes treated with distilled water gave:

“	“	0.0076 grams	Ag	gave	Chlorine,'	0.09	“ “
“	“	0.0347 “	$2MgO, PO_5$	“	Phosphoric Acid,	0.78	“ “
“	“	0.1099 “	BaO, SO_3	“	Sulphuric Acid,	1.33	“ “

Lime,	1.27	per cent.	Oxygen ratio,	0.36
Phosphoric Acid,	0.81	“ “	“ “	0.45
Sulphuric Acid,	1.49	“ “	“ “	0.89

Guano Rock has been brought from another group of islands called Centinella, consisting of peaks, which sometimes attain a height of 800 ft. The rock is described as consisting of two layers, the upper of which is a dark-brown compact rock, varying slightly from the lower layer. This so called lower layer has certainly a surface exposed, as the specimen which I have examined, has been much weathered; the outer portion is partially reniform, which in places shows a slight enamel, though not near as distinct as on the specimens from Monk's and El Roque islands. It has evidently been formed in layers, which when broken across show a slightly banded appearance not unlike that already described as characteristic of portions of the rock from Monk's Island; the color varies from a buff to an ochreous brown; it is hard, brittle and much more readily pulverized than the Monk's Islands guano rock. An opinion may seem premature, but I am inclined to the belief that this has once been as the guano rock from Monk's Island, which has undergone changes from causes not yet fully studied, which seems more probable from the fact that small quantities of Phosphate of Alumina have been found in the Monk's Island rock.

The whitest portion of the rock was selected for analysis, which gave the following results:

(VII.)

1.5165	grams.	ignited gave .3469 grams.					22.87	per ct.
“	“	0.2000	grams.	insoluble matter,		Silica,	13.18	“
“	“	0.0474	“	BaO, SO_3	gave	Sulphuric Acid,	1.07	“
“	“	0.6921	“	$2MgO, PO_5$	“	Phosphoric Acid,	29.23	“
“	“	0.0720	“	CaO, CO_2	“	Lime,	2.66	“
1.3048	“	0.2120	“	Al_2O_3	“	Alumina,	16.24	“
“	“	0.1628	“	Fe_2O_3	“	Sesquioxide of Iron,	12.41	“
“	“	0.6438	“	$2MgO, PO_5$	“	Phosphoric Acid,	31.60	“
“	“	0.0660	“	CaO, CO_2	“	Lime,	2.83	“
“	“	0.0057	“	$2Al_2O_3, 3PO_5$?	“	Phosphate of Alumina,	0.43	“

Water?	22.87	per cent.	Oxygen ratio,	21.54
Silica,	13.18	“ “	“ “	6.84
Sulphuric Acid,	1.07	“ “	“ “	0.65
Phosphoric Acid,	31.60	“ “	“ “	20.24
Lime,	2.66	“ “	“ “	0.75
Alumina,	16.24	“ “	“ “	7.59
Sesquioxide of Iron,	12.41	“ “	“ “	3.61

The 0.65 of Oxygen of the Sulphuric Acid requires 0.22 of the Oxygen of the Lime, the remaining lime is most likely combined with Carbonic Acid, as nearly every specimen on treating with dilute acid gave a slight effervescence, (the guano rock from the vertical cliff contained nearly one per cent.), or possibly a remnant of the once phosphate of lime still exists. The alumina and phosphoric acid exist most likely in the form of Wavellite which has the formula $3Al_2O_3, 2PO_5+12HO$. It is difficult in a rock which is in progress of decomposition to obtain other than approximate formulæ.

This island of Centinella is now inhabited by immense numbers of waterfowl, many of which roost on the cliffs; some of these roosts have been long occupied, and judging from the signs on the rocks beneath, have been much resorted to. Mr. Richards of this city, who visited the islands a short time since broke off a portion of the concretion which cover the cliffs beneath a bird roost of this description; the organic properties had mostly been removed by causes which had converted the inorganic constituents into a guano rock, which in its composition, is not unlike that from Monk's Island and El Roque. Mr. Richards mentioned that when first obtained it had quite a strong odor, which has now almost disappeared; it is very hard and was difficult to powder.

The analysis of the concretion is as follows:

(VIII.)

2.0904 grams.	on ignition lost 0.2361 gram				11.29 per ct.
2.2904 “	0.0248 grams.	$Al_2 O_3$	gave	Alumina,	1.08 “
.8470 “	0.066 “	BaO, SO_3	“	Sulphuric Acid,	2.67 “
“ “	0.4707 “	CaO, CO_2	“	Lime,	31.18 “
“ “	0.0406 “	$2MgO, PO_5$	“	Magnesia,	1.74 “
“ “	0.0143 “	Fe_2O_3 & Al_2O_3	“	Iron and Alumina,	1.69 “
“ “	0.0506 “	insoluble,	“	Silica,	5.97 “
1.8570 “	1.0153 “	CaO, CO_2	“	Lime,	30.68 “
“ “	0.0926 “	$2MgO, PO_5$	“	Magnesia,	1.79 “
“ “	0.0346 “	Fe_2O_3 Al_2O_3	“	Alumina and Iron,	1.86 “
“ “	1.2520 “	$2MgO, PO_5$	“	Phosphoric Acid,	41.89 “
1.2142 “	contained 0.0089 grams.	CO_2	“	Carbonic Acid,	0.73 “

Alumina and Iron,	1.86 per cent.	Oxygen ratio,	0.86
Sulphuric Acid,	2.67 “ “	“ “	1.59
Carbonic Acid,	0.73 “ “	“ “	0.54
Lime,	31.18 “ “	“ “	8.86
Magnesia,	1.74 “ “	“ “	0.69
Phosphoric Acid,	41.89 “ “	“ “	23.25

1.59 Oxygen of Sulphuric Acid require 0.53 of Oxygen of the lime; 0.53 of Oxygen of the Carbonic Acid require 0.27 Oxygen of the lime, but if there is added to this remainder the Oxygen of the Magnesia there remains 8.75 Oxygen of lime, which is to the Oxygen of Phosphoric Acid 23.25, about in the ratio of 1 : 2, particularly as the Oxygen of the Alumina requires Oxygen of the Phosphoric Acid, to form a salt with a formula most probably corresponding to that of Wavellite as before mentioned.

Mr. Richards brought with him also a specimen of the recent alluvial guano, or bird excrement, as it may be justly termed; he obtained it from a little nook in the rocks, where it was protected from the intense dry heat of the sun and from the action of water. Mixed through it were several birds feathers. As may readily be imagined it had some odor, though not excessively strong.

7.4921 grams. were ignited in a platinum crucible, and gave a very strong and disagreeable odor like burning hair; it was moistened with carbonate of ammonia and again gently heated, and gave a loss of 4.0032 grams.,=53.83 per ct.

(IX.)

2.1975 grams.	of the ash showed a trace of Alumina.				
“ “	0·2746 grams.	BaO, SO_3	gave	Sulphuric Acid	4.29
2.236 grams.	1.5150 “	CaO, CO_2	“	Lime	38.02
“ “	0.0913 “	Sand	“		4.83
4.0704 grams.	ignited gave a loss 1.9171 gram.				47.10
1.9997 “	Ash				
“ “	1.3858 grams.	CaO, CO_2	gave	Lime	38.89
“ “	0.2206 “	BaO, SO_3	“	Shlphuric Acid	3.79
“ “	0.2100 “	$2MgO, PO_5$	“	Magnesia	3.77
“ “	1.3178 “	$2MgO, PO_5$	“	Phosphoric Acid	42.21
“ “	0.0225 “	Sand	“		3.25
“ “	0.0164 “	Ag	“	Chlorine	0.26
3.9652 grams.	loss by ignition 1.9282 gram.				48.62
.9857 “	0.6892 grams.	CaO, Co_2	gave	Lime	39.12
.9794 “	0.0085 “	CO_2	“	Carbonic Acid	0.86
“ “	0.1250 “	BaO, SO_3	“	Sulphuric Acid	4.28

Lime	38.89 per cent.	Oxygen ratio,	11.05
Phosphoric Acid,	42.21 “	“	23.65
Sulphuric Acid,	4.29 “	“	2.57
Magnesia,	3.77 “	“	1.50

March.

2.57 Oxygen in Sulphuric Acid require 0.85 oxygen in Lime, there remains 10.19 oxygen of lime, which, if added to the oxygen of the magnesia makes 11.69, which stands with the oxygen of the phosphoric acid 23.65 near the ratio $2CaO, PO_5$.

A guano rock has recently been brought from a group of Islands called El Roque, in the Caribbean Sea. In composition it resembles very closely that brought from Monk's Island, the specimens that I have analysed, contain however, a much larger quantity of sulphuric acid than has been found in the latter rock. The appearance of the body of the two rocks is also much alike, but in the specimens which I have seen from El Roque the exterior crust is very different; it is rarely more than a slight coating; in some places it has a slight appearance of the enamel, when examined with a pocket lens; the surface is very irregular, often containing cavities which are lined with the same white coating. It was impossible to obtain sufficient of this for analysis: the analysis of the black portion of the rock was as follows:

(X.)

1.8636	grms.	loss by ignition 0.1904	grms.		water and organic matter	10.22	per ct.
1.4609	“	0.3274	grams. BaO, SO_3	gave	Sulphuric Acid,	7.70	“
“	“	1.0066	“ CaO, CO_2	“	Lime,	38 67	“
“	“	0.1118	“ 2MgO, PO_5	“	Magnesia,	2.75	“
“	“	0.0116	“ Insoluble			0.78	“
“	“	0.0058	“ Fe_2O_3 & Al_2O_3		Iron & Alumina	0.40	“
1.1680	grams	0.7936	gram. CaO, CO_2	gave	Lime,	38.12	“
“	“	0.0879	“ 2MgO, PO_5	“	Magnesia,	2.70	“
“	“	0.7383	“ 2MgO, PO_5	“	Phosphoric Acid,	40.49	“

Organic matter and water, 10.22 per cent.

Sulphuric Acid,	7.70	Oxygen Ratio,	4.61
Lime,	38.67	“	10.09
Magnesia,	2.75	“	1.09
Phosphoric Acid,	40.49	“	25.93
Alumina and sesquiox-ide of Iron,	0.40	“	
Insoluble,	0.78	“	

4.61 oxygen in Sulphuric Acid require 1.54 oxygen in lime; therefore remains 8.55 oxygen in lime which stands with the oxygen of Phosphoric Acid 25.93 in the ratio 1 : 3, showing that the phosphate in this specimen consists principally of $3CaO PO_5$.

A specimen containing no organic matter was examined from Testigoe Island, but the rock was very much disintegrated; it was very porous, and evidently had been acted upon by some causes which were gradually removing all its components except the silica. In appearance it was largely a sandstone, as the analysis showed. The most compact portion of the specimen was selected, which was readily pulverized; the results of the analysis differ from all the other specimens. The following are the results:

(XI.)

1.2910 grams. insoluble	silica 0.6722 grams.			52.07	per cent.
“	0.0085 CaO, CO_2	gave	Lime,	0.37	“
“	0.0206 2MgO	“	Magnesia,	0.57	“
0.8806 grams.	0.1073 loss by ignition		Water,	12.17	“
0.8806 grams. insoluble	0.4600 grams.		Silica,	52.27	“
			Sulphuric Acid trace,		
“	0.1158 $Al2O_3$	“ gave	Alumina,	13.03	“
“ $2Fe_2O_3$, $3PO_5$	0.0318	“ “	Phosp. of Iron	3.61	“
“ 2MgO, PO_5	0.2394	“ “	Phosp. Acid,	17.41	“

Silica,	52.07	per cent.		
Lime,	0.37	"		
Magnesia,	0.57	"		
Water,	12.17	"	oxygen ratio,	10.81
Sulphuric acid trace				
Alumina,	13.03	"		6.12
Phosphate of Iron,	3.61	"		
Phosphoric Acid,	17.41		"	9.81

The Alumina and Phosphoric Acid seem in this to be in the form of wavellite.

The guano rock from the various groups of islands has very varying composition, as has been seen from the foregoing investigations; it is found in layers, and the surface sometimes covered with an alluvial deposit; these layers are in places highly inclined, showing that since their deposition dynamic causes have altered their original position. This same phenomenon is described as occurring at the Chincha islands in the Peruvian guano, where it is found in layers two or three yards in thickness. Various theories have been formed and published as to the origin of the rock guano; these are doubtless premature, as the accounts as to its occurrence are founded on reports of those not accustomed to noting geological phenomenon.

Prof. C. U. Shepard has, with his characteristic energy, extended his mineralogical species to various portions of this rock, which he severally describes* and designates generally as Pyroguanite minerals, and entirely destitute of ammonia; but examinations made of an average sample of a cargo from Monk's Island showed one-half per cent. of nitrogen. Every specimen which I have examined, has on ignition given very marked evidence of burning organic matter. How this can be retained in a rock subjected to the agency of heated trap is as difficult to reconcile, as that the composition of minerals existing with and forming a part of its mass, as Prof. Shepard describes,* containing water in their composition. Moreover, how can a rock subjected to the agency of heated trap have as its principal basis a salt with the formula $2CaO, HO, PO_5$ which is the formula ascribed to it by Drs. Piggot and Beckell, of Baltimore, and which seems to be the proper composition of some portions, as shown by analysis of Monk's Island rock (V), though in the analysis of the specimen from El Roque (X) there is obtained the formula, $3CaO\ PO_5$.

As I have already mentioned, this Guano rock from *Los Monges* has been called a native Super-Phosphate of Lime, but no satisfactory proofs are given as to its meriting such a name; phosphoric acid being found in solution after the guano is treated with water is no proof that it exists in a free state. Phosphate of Lime, when recently precipitated, is soluble to a slight extent in pure water (R. Phillips, Ann. Phil. 22,188). Berzelius long since discovered Phosphates of Lime and Alumina in the water and deposits of hot springs at Carlsbad.† That Phosphates are insoluble and must be rendered free before becoming efficacious as fertilizers is an erroneous though a very prevalent opinion. According to Brischof‡ Phosphate of Lime must be regarded as present in all water running into the sea; it has already been detected in the waters of the Dee and and of the Don, and it will most likely be found in the waters of all rivers. Phosphate of Lime and Magnesia have also been found in the waters of an artesian well at Wildegg, in the Canton Argan (Switzerland). Phosphote of Lime has been shown to be present in sea water by Clemm§ and by Forchammer.‖ According to Berzelius it is the *Di*-phosphate which is found in the mineral waters,¶ which is readily soluble in water saturated with carbonic acid. The Basic-Phosphate of Lime is also readily soluble in water containing carbonic acid; Bischof gives

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[*] Am. J. Sci. 12, xxii. 96.

[†] Gilbert's Annalen, lxxiv. 136.

[‡] Chem and Phys. Geology, vol. 2, p. 27 (Engl. edit).

[§] Journ. fürprakt. Chemie xxxiv. 185.

[‖] Berzelius, Jahresbericht xxvi. 393.

[¶] Gmelin, vol. iii. p. 195.

a very interesting table of the degrees of solubility of the various basic-Phosphates of Lime in water saturated with carbonic acid gas.[*]

It is not only in carbonic acid waters that Phosphate of Lime is soluble; basic-Phosphate of Lime dissolves in 3.150 parts of water, containing one-twelfth by weight of Chloride of Sodium. The presence of Chloride of Ammonium increases the solubility still more.[*]

It is probable, therefore, that the solubility of the Phosphate of Lime Guano rock from Los Monges is owing to the presence of the Chloride of Sodium existing in it. By reference to the analyses (II and III), it will be seen that the Phosphate of Lime dissolved is in proportion to the Chloride of Sodium in the specimens. This will, however, require more detailed examination.

Though the rock from Centinella containing so large a percentage of Phosphoric Acid combined with Iron and Alumina may seem at first worthless as a fertilizer, no positive opinion should be formed or expressed without a very careful investigation of the subject, which I believe has never yet been made. It is true that Phosphate of Alumina is one of the most sparingly soluble substances known, though it is soluble in water saturated with Carbonic Acid, according to Bischof in about 6.828.000 parts, though in the water of the Carlsbad springs about double this quantity is held in solution, viz: $\frac{1}{3\cdot125000.}$[†]

Though the Phosphate of lime is applied to soils, and, as such, taken up by plants, there is no proof that it remains in that form until the plants have need of it; it enters into new combinations, some of which may be quite as insoluble as this Centinella rock. The Phosphate of Lime dissolved by the carbonated waters always found more or less in soils,[‡] is decomposed by alkaline carbonates; the lime would therefore be converted into a carbonate, and a phosphate of the alkali will be formed.[§] Bousingault and Levy, Journ. des Debats, Dec. 5, 1852, found that the air in the insterstices of arable soils contained as much as 22 to 23 times as much carbonic acid as the atmosphere, and when the soil has been recently moistened 245 times as much. Phosphate of lime lying in such a soil would be dissolved in a comparatively short space of time.

Carbonate of Iron is present more or less in every soil, and consequently if in a soil the carbonate of iron and phosphate of lime exist, both held in solution by a carbonate of the alkalies, a mutual decomposition may take place[||], consequently we may have vivianite formed in the soil: instances are frequent of vivianite in fossils of the green sand of New Jersey,[¶] but geological ages are not required to produce these changes. M. Jerome Nickles has recognised its presence in human bones, (Amer. Jour. of Sci. vol. xxi. p. 402.) he found in a cemetery at

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[*] Chem. and Phys. Geology, vol. ii. p. 28.

[†] (Chem and Phys. Geol. vol. ii. p. 34.

[‡] Researches that have been made by Lassaigne, Journ. Chim. Med. 3 ser. iv. 354; and Ann. de Chim. et. de Phys. 3 ser. xxv. 346, show that phosphate of lime is conveyed into the plants organism by water saturated with carbonic acid. Dumas (Comptes Rendus, xxiii. 1018,) holds the same opinion.

[§] Bischof, Chem. and Phys. Geology, vol. i. p. 13. No. 19. Phosphate of lime dissolved in carbonated water forms Carbonate of Lime, which is precipitated, and alkaline phosphate which remain in solution.

[||] Phosphate of lime dissolved in carbonated waters and proto-carbonate of iron form a proto-phosphate of iron, which is precipitated, and bi-carbonate of lime which remains in solution. (Bischof vol. i. p. 13, no. 20.

[¶] In the green sand of New Jersey, the decomposition is not owing probably to the carbonate of iron, but to the sulphate resulting from oxydation of the iron pyrities. (Bischof, vol. i. p. 14, no. 21.) Phosphate of iron and proto-sulphate of iron form sulphate of lime and proto-phosphate of iron,) Similar changes probably result in this guano rock, as in many specimens we find crystals of gypsum recognizable with a pocket-lense.

Eumont a village in the department of La Meurthe, the earth of which was very ferruginous, two arm bones of a female, a cubitus and a radius, having a deep bluish green color. On breaking, the alteration was found to be complete, and a qualitative chemical examination proved it to be phosphate of iron. It is to be regretted that a quantitative analysis was not made, to have determined whether all the bone phosphate had been decomposed and the transformation into phosphate of iron complete. M. Nickles, on examining the medullary cavity with a lens, found among the sinuosities left by the hardened marrow brilliant points which were distinctly crystals of vivianite. The bones were in a perfect state of preservation, and afforded, when treated with hydrochloric acid, a skeleton of gelatine, proving that gelatine does not resist the absorption of the ferruginous compound.

Various theories have been formed and published as to the origin of the rock guano; these are most likely premature, as the accounts as to its occurrence are founded on reports of those not accustomed to noting geological phenomena. The continued and gradual upheaval of islands in the ocean and their depression is a well established geological fact.

The islands of the Caribbean sea are very varied, some are quite low and covered with sand composed of fragments of shells, madrepore and corals, which can readily be distinguished with a pocket lens. These sands are resorted to by myriads of waterfowls for laying their eggs. One of the captains who visited there mentions, that it is necessary to make one's way through them with a stick. Other islands attain heights of 800 feet; it seems improbable that such heights could be created by accretions of guano and sand, when the islands were subject to a continued action of the waves of the ocean. The inclination and irregularity of the guano layers renders it not improbable that the dynamic causes which produced this distortion, elevated at the same time the islands.

It is most probable that the guano rock from some of the islands has been changed in its composition by reactions of the salts contained in sea water, but before such reactions can be fully explained, accurate analyses must be made of this sea water.

It is a remarkable fact, that the composition of the ash from the recent guano from the heights of the Centinella rock composed of phosphates of alumina and iron, should have a composition so very near to that of the guano rock from the Los Monges and El Roque islands.

The frequent occurrence of alumina and iron is to be remarked in the guano rocks.

The upheaval and subsidence of land is caused not only by earthquakes, (Lyell's Principles of Geology, 8th edit. chap. xxxi.,) but by other changes such as are in progress in Sweden and Norway, and in Greenland. The upheaval of islands in the Caribbean Sea may most likely be ascribed to volcanic action, some of these are within 150 miles from Gaudaloupe. (Lyell's Principles, 336,) von Buch inclined to the belief, that the volcanic chain of the Andes was connected with that of the West India or Caribbean Islands. The truth of this conjecture has been almost set at rest by the eruption of the volcano at Zamba, in New Grenada, at the mouth of the river Madalena.*

The vicinity of the volcanoes may give additional salts to the sea water.

NOTE.—I have just been informed by Dr. Luther, that from analyses lately made in Baltimore of a cargo of rock guano, that has lately arrived from the island of Testigoes, there has been found from forty to forty-five per cent. of phosphoric acid.

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* Comptes Rendus, 1849, vol. xxix. p. 531.